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HEAT DISSIPATING/SHOCK ABSORBING STRUCTURE FOR SUBMARINE REPEATER

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[There are no amendments to this patent.]

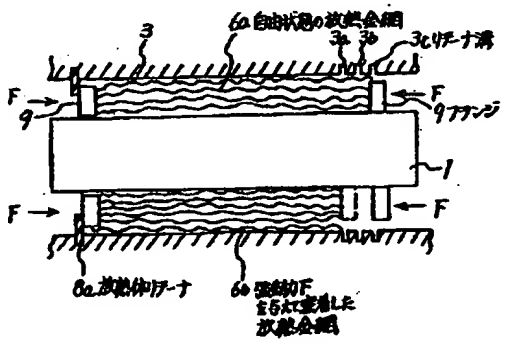
Abstract

Constitution

Heat dissipating metal mesh (6) composed of plural woven pieces of lateral metal wires (4) and longitudinal metal wires (5) that have been formed in wavy shape is inserted into the gap between cylindrical internal unit (1) and outer housing (3). Heat dissipating metal mesh (6a) in a free state does not contact the inner peripheral surface of outer housing (3). When restraining force F is applied on it through flange (9) extends it in the radial direction, it contacts the inner peripheral surface of outer housing (3). An optimum contact state is maintained by fitting and fixing heat dissipating member retainer (8b) in any of retainer grooves (3a), (3b) and (3c). Heat in internal unit (1) is dissipated through heat dissipating metal mesh (6) to outer housing (3).

Effects

Heat inside the internal unit can be dissipated at a high efficiency to the outer housing without stagnation. By means of stretching the heat dissipating metal mesh in the radial direction, there is no need for strict control of dimensions, and assembly can be performed easily. As a result, quality reliability is improved and the manufacturing cost is lowered.



Key:
- 3c Retainer groove
- 6a Heat dissipating metal mesh in free state
- 6b Heat dissipating metal mesh brought in close contact under restraining force F
- 8a Heat dissipating member retainer
- 9 Flange

Claims

1. A heat dissipating/shock absorbing structure for a submarine repeater characterized by the following facts: the heat dissipating/shock absorbing structure for the submarine repeater realizes a shock absorbing function while dissipating heat between a cylindrical internal unit that has a circuit unit contained in it and has its periphery covered with an insulating layer and an outer housing that contains the internal unit; the heat dissipating/shock absorbing structure has a shock absorbing member that holds the aforementioned internal unit inside the aforementioned outer housing, and a heat dissipating metal mesh, which is inserted between the aforementioned internal unit and the aforementioned outer housing and is composed of plural woven pieces of lateral metal wires and longitudinal metal wires that have been formed in a wavy shape; when the aforementioned heat dissipating metal mesh is in a free state, it does not contact the inner peripheral surface of the aforementioned outer housing; when it is pressed in the axial direction of the aforementioned cylindrical configuration, it stretches in the radial direction and contacts the inner peripheral surface of the aforementioned outer housing.

2. The heat dissipating/shock absorbing structure for a submarine repeater described in Claim 1 characterized by the fact that fixing grooves for fixing the aforementioned heat dissipating metal mesh at the position with the best contact state under pressure in the axial direction are formed at least at two sites on the inner peripheral surface of the aforementioned outer housing.

Detailed explanation of the invention

[0001]

Industrial application field

This invention pertains to a heat dissipating/shock absorbing structure for a submarine repeater. In particular, this invention pertains to a heat dissipating/shock absorbing structure for a submarine repeater characterized by the fact that it can realize a reliable heat dissipating effect without requiring particularly high dimensional precision.

[0002]

Prior art

Figure 5 is a longitudinal cross-sectional view illustrating a basic example of a conventional heat dissipating/shock absorbing structure for a submarine repeater. As shown in Figure 5, the basic heat dissipating/shock absorbing structure for a submarine repeater of this type has heat dissipating member (11) formed in cylindrical shape set at the central portion of the outer periphery of internal unit (1) and between [the internal unit] and outer housing (3). Rubber caps (2) are applied on the two ends of internal unit (1) with the aid of retainers (7).

[0003]

In the following, three examples of the prior art will be examined pertaining to heat dissipating member (11) which plays an important role in heat dissipating/shock absorbing. In the first example of the prior art, a thin rolled sheet and heat dissipating pieces are used. In the second example of the prior art, a metal mesh laminated molding is used (such as in Japanese Kokai Patent Application No. Sho 63[1988]-148814). In the third example of the prior art, an air-tight bag filled with metal fibers is used (such as in Japanese Kokai Patent Application No. Sho 56[1981]-32839).

[0004]

Figure 6(a) is a diagram illustrating the first example of the prior art. As shown in this figure, heat dissipating member (11) is composed of two thin rolled sheets (13), which have plural semi-arc-shape heat dissipating plates (12) set on their circumference and are fastened with band (14). The overall thickness of heat dissipating member (11) including the thickness of semi-arc-shape heat dissipating plates (12) and the thickness of thin rolled sheets (13) is larger than gap between internal unit (1) and outer housing (3) so that they are in contact with each other for transferring heat from within internal unit (1) to outer housing (3). Also, as shown in Figure 6(b), heat of heat dissipating member (20) in the unit becomes heat flow (31) from the surface of heat dissipating member (11) into space to ensure smooth heat transfer. However, heat dissipating member (20) is set inside the unit, and heat stagnation (32) may take place in the prescribed space between heat dissipating plates (12).

[0005]

Figure 7 is a diagram illustrating the second example of the prior art. As shown in this figure, cover (16) is set on metal mesh laminated molding (15) to form heat dissipating member (11). In order to obtain the desired spring rigidity needed for a heat dissipating/shock absorbing member, the compression rate of the laminate is selected appropriately during molding of the metal mesh, and, in order to maintain the shape of the molding and to ensure reliable contact with outer housing (3), cover (16) is used.

[0006]

Figure 8 is a diagram illustrating the third example of the prior art. As shown in this figure, air-tight bag (17) is used as heat dissipating member (11). Metal fibers (18) are filled as heat dissipating/shock absorbing member in air-tight bag (17). After said bag is inserted in this

state into the gap of outer housing (3), space (19) of air-tight bag (17) is filled with high-pressure air to inflate it so as to realize the desired shock absorbing property.

[0007]

Problems to be solved by the invention

The aforementioned conventional heat dissipating/shock absorbing structures for a submarine repeater have their problems. For the first and second examples of the prior art, in order to ensure reliable contact with the outer housing, the dimensions of the heat dissipating member have to be controlled strictly. Also, in the first example of the prior art, it is hard to ensure a prescribed contact pressure from the viewpoint of manufacturing of the heat dissipating member. Also, in the first representation of the prior art, the heat dissipating member is made of heat dissipating plates and thin rolled sheets, with the thin rolled sheets fastened with a band in the circumferential direction so as to be installed on the internal unit. When the heat dissipating member is inserted along with the internal unit into the outer housing, the friction force between the internal unit, which is covered with an insulating layer of polyethylene sealant or the like, and the heat dissipating member may be smaller than that between the heat dissipating plates and the outer housing, due to the degree of fastening of the thin rolled sheets by the band. Consequently, the heat dissipating member will slip, and it cannot be kept securely between the outer housing and the internal unit. In addition, when insertion occurs, metal dust may be generated due to contact between the heat dissipating plates and the outer housing, leading to degradation in quality. This is a major disadvantage. Also, when the heat dissipating member becomes biased within the unit, heat stagnation may take place. Since such heat is concentrated on a prescribed portion on the surface of the outer housing as it is dissipated into the ambient environment, the heat dissipating efficiency is low. In addition, because contact between the heat dissipating plates and the outer housing is a linear contact, thermal conduction efficiency from the heat dissipating plates is poor, and, in order to realize prescribed characteristics, the number of heat dissipating plates may have to be increased.

[0008]

In the second example of the prior art, although it is easy to ensure a prescribed contact pressure by means of the metal mesh laminated molding, it is nevertheless necessary to use a cover to maintain the shape. This is undesirable. In the third example of the prior art, although there is no need for strict control of dimensions and it is easy to ensure a prescribed contact pressure, a bulky air feeding device is needed to inject high-pressure air. This is a disadvantage.

[0009]

The objective of this invention is to solve the aforementioned problems of the conventional methods by providing a heat dissipating/shock absorbing structure for a submarine repeater characterized by the fact that it can realize a high heat dissipating efficiency without requiring strict precision of dimensions.

[0010]

Means to solve the problems

This invention provides a heat dissipating/shock absorbing structure for a submarine repeater characterized by the following facts: the heat dissipating/shock absorbing structure for a submarine repeater realizes a shock absorbing function while dissipating heat between a cylindrical internal unit that has a circuit unit contained in it and has its periphery covered with an insulating layer and an outer housing that contains the internal unit; the heat dissipating/shock absorbing structure has a shock absorbing member that holds the aforementioned internal unit inside the aforementioned outer housing, and a heat dissipating metal mesh, which is inserted between the aforementioned internal unit and the aforementioned outer housing and is composed of plural woven pieces of lateral metal wires and longitudinal metal wires that have been formed in a wavy shape; when the aforementioned heat dissipating metal mesh is in a free state, it does not contact the inner peripheral surface of the aforementioned outer housing; when it is compressed in the axial direction of the aforementioned cylindrical configuration, it stretches in the radial direction and contacts the inner peripheral surface of the aforementioned outer housing.

[0011]

Application example

In the following, this invention will be explained in detail with reference to an application example illustrated by figures.

[0012]

Figure 1 is a longitudinal cross-sectional view of an application example of this invention. Figure 2 is an oblique view of the heat dissipating metal mesh used in this application example. Figure 3 is a cross-sectional view illustrating the state when the structure of this application example is installed in a housing. Figure 4 is a cross-sectional view illustrating the function and effect of this invention.

[0013]

The structure of this application example has internal unit (1), rubber caps (2), outer housing (3), heat dissipating metal mesh (6), retainers (7), heat dissipating member retainers (8a), (8b), and pressure-resistant covers (10). As shown in Figure 2, heat dissipating metal mesh (6) is composed of plural woven pieces of wavy lateral metal wires (4) and wavy longitudinal metal wires (5). Flanges (9) are set on the two ends of said heat dissipating metal mesh (6), respectively. Also, heat dissipating member retainers (8a), (8b) are for installing and fixing heat dissipating metal mesh (6) in outer housing (3).

[0014]

As shown in Figure 1, internal unit (1) is a cylindrical unit that has a circuit unit contained inside it, and has its periphery covered with an insulating layer made of polyethylene or the like. Said internal unit (1) is held in cylindrical outer housing (3) via a gap for inserting heat dissipating metal mesh (6) as its two ends are held with rubber caps (2). Rubber caps (2) fix and support internal unit (1) on the inner wall of outer housing (3) by means of an elastic force with respect to force in the outer peripheral direction, and they are fixed and held by means of retainers (7) fixed in groove portions formed on the circumference of outer housing (3) with respect to force in the axial direction. Heat dissipating metal mesh (6) that transfers heat generated from internal unit (1) to outer housing (3) is inserted and installed in the gap between internal unit (1) and outer housing (3). As shown in Figure 2, heat dissipating metal mesh (6) is in good contact with the outer peripheral surface of internal unit (1) and the inner peripheral surface of outer housing (3), because it is prepared by weaving plural wavy molded lateral metal wires (4) and longitudinal metal wires (5).

[0015]

As shown in Figure 3, when said heat dissipating metal mesh (6a) is in a free state, because heat dissipating metal mesh (6) is formed along the outer peripheral surface of internal unit (1), it is not in contact with the inner peripheral surface of outer housing (3). On the other hand, when restraining force F is applied from flanges (9) on the two ends, due to the restraining force shown in Figure 3, heat dissipating metal mesh (6b) closely contacts said housing. That is, it stretches in the radial direction to spread to the inner peripheral surface of outer housing (3) to realize a good contact state. The wavy metal wires of heat dissipating metal mesh (6) have numerous contact points on both internal unit (1) and outer housing (3). In order to maintain the position for the best contact state under restraining force F, plural retainer grooves (3a), (3b), (3c) are formed on the inner peripheral surface of outer housing (3). Heat dissipating member

retainer (8b) is fit in any of these grooves to realize an optimum state in installing and fixing heat dissipating metal mesh (6).

[0016]

For the aforementioned structure of this application example, the gap between internal unit (1) and outer housing (3) is filled with heat dissipating metal mesh (6) with a heat conductivity that is more than 10 fold higher [than that of the gap], so it is possible to perform thermal conduction at a high efficiency. As shown in Figure 4, even when bias occurs in heat generating member (20) inside the unit, it is still possible to form smooth heat flow (30) through the uniform mesh openings of heat dissipating metal mesh (6), and a good heat dissipating property is realized. Also, it is possible to variously change the size, curvature of the wavy shape, etc. of lateral metal wires (4) and longitudinal metal wires (5) of heat dissipating metal mesh (6) corresponding to the conditions of the repeater.

[0017]

Effect of the invention

As explained above, according to this invention, radial stretching of the wavy formed metal wires or [sic; of the] heat dissipating metal mesh in the space between the internal unit and the outer housing is exploited to ensure contact between the [heat dissipating metal mesh and the] internal unit and the wall surface of the outer housing under a prescribed pressure, so it is possible to maintain high-efficiency thermal conduction between the internal unit and outer housing. Also, as shown in Figure 4, even when bias occurs in the heating [member] inside the unit, heat still can be transferred at a high efficiency to the housing through the metal mesh that fills the gap uniformly. Consequently, it is possible to realize a uniform temperature distribution around the circumference of the housing.

[0018]

In addition, for the heat dissipating metal mesh, because its stretching in the radial direction is used, when it is inserted into the outer housing, no metal dust is formed. This is preferred from the viewpoint of quality reliability. Also, strict control of dimensional precision is not required, and the use of a cover for the heat dissipating metal mesh or the use of an air feeding device is not required. Consequently, the manufacturing cost can be reduced significantly.

Brief description of the figures

Figure 1 is a longitudinal cross-sectional view of an application example of this invention.

Figure 2 is an oblique view of the heat dissipating metal mesh used in the application example of this invention.

Figure 3 is a cross-sectional view illustrating the state when the structure in the application example of this invention is installed in a housing.

Figure 4 is a cross-sectional view illustrating the function and effect of this invention.

Figure 5 is a longitudinal cross-sectional view illustrating an example of a conventional heat dissipating/shock absorbing structure for a submarine repeater.

Figure 6(a) is an oblique view illustrating the first example of the prior art, and Figure 6(b) is a cross-sectional view illustrating its heat flow.

Figure 7 is an oblique view illustrating the second example of the prior art.

Figure 8 is a longitudinal cross-sectional view illustrating the third example of a conventional heat dissipating member.

Brief explanation of reference numbers

1 Internal unit
2 Rubber cap
3 Outer housing
3a, 3b, 3c Retainer groove
4 Lateral metal wire
5 Longitudinal metal wire
6 Heat dissipating metal mesh
6a Heat dissipating metal mesh in free state
6b Heat dissipating metal mesh in close contact state under pressure of restraining force F
7 Retainer
8a, 8b Heat dissipating member retainer
9 Flange
10 Pressure-resistant cover

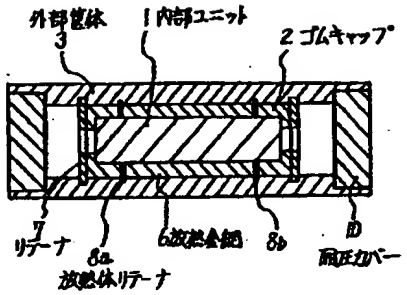


Figure 1

Key:
1 Internal unit
2 Rubber cap
3 Outer housing
6 Heat dissipating metal mesh
7 Retainer
8a Heat dissipating member retainer
10 Pressure-resistant cover

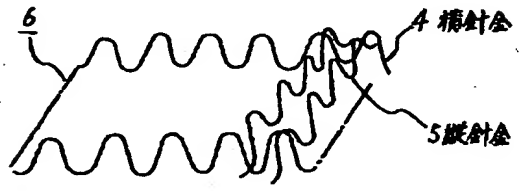


Figure 2

Key:
4 Lateral metal wire
5 Longitudinal metal wire

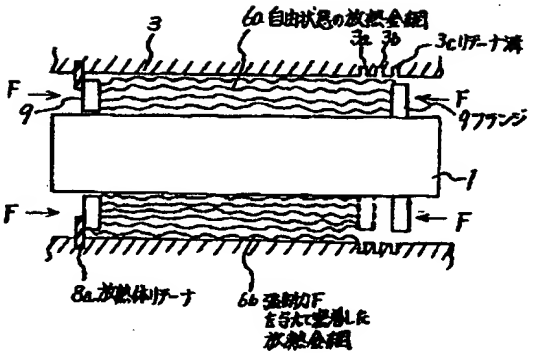


Figure 3

Key: 3c Retainer groove
6a Heat dissipating metal mesh in free state
6b Heat dissipating metal mesh in close contact state under pressure of restraining force F
8a Heat dissipating member retainer
9 Flange

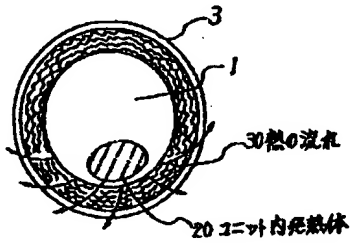


Figure 4

Key: 20 Heating member within the unit
30 Heat flow

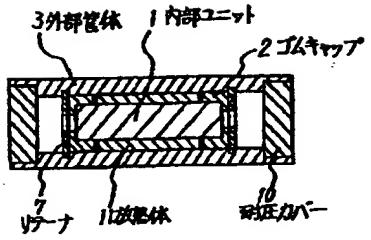


Figure 5

Key:
1 Internal unit
2 Rubber cap
3 Outer housing
7 Retainer
10 Pressure-resistant cover
11 Heat dissipating member

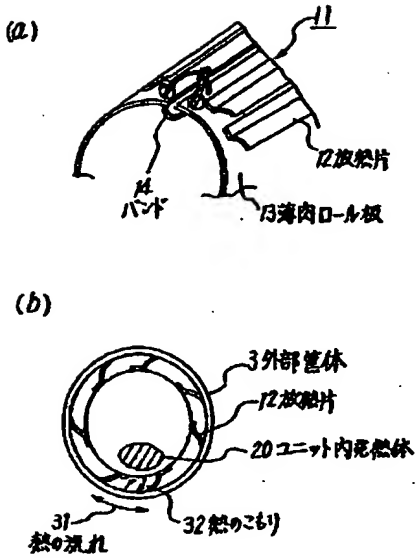


Figure 6

Key:
	3	Outer housing
	12	Heat dissipating plate
	13	Thin rolled sheet
	14	Band
	20	Heating member within the unit
	31	Heat flow
	32	Heat stagnation

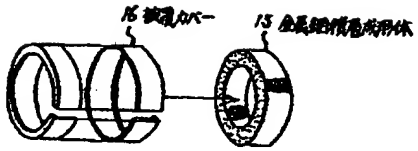


Figure 7

Key: 15 Metal mesh laminated molding
16 Cover

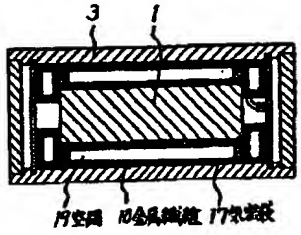


Figure 8

Key: 17 Air-tight bag
18 Metal fibers
19 Space